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## ENGINEERING-SCIENCE, INC.

FACSIMILE TRANSMISSION
TOTAL PAGES: 9 PROPOSAL/PROJECT NO.: 722446 22014  ATTENTION: Dave Ericson CITY/STATE: Golden CO  COMPANY NAME: EGGG  TELECOPY NO.: ( ) 966 - 8768  FROM: Phil Nixon Date: June 24 1994  SUBJECT/REFERENCE: No- Action Risk data  RECEIVING OFFICE - SPECIAL INSTRUCTIONS:  Dave Ericson  [] RESPONSE DUE:
COPY AND DISTRIBUTE TO:
MESSAGE:
Enclosed is risk data for
chemicals under the no-Action
Alternative 1.5 x 10-3 (cancer) which does
not include radionuclides. Hazard
index 47.5 (noncancer). Our
goal 1.0×10-6 (cancer) and
Hazard Index should be 1

ES-1-12

The following tables present the carcinogenic and noncarcinogenic risks associated with the no action alternative at OU4, Rocky Flats Site for surficial soils. The total hazard index (the sum of the noncarcinogenic hazard quotients) for surficial soils is 47.5, much greater than EPA's threshold of 1. Risk Assessment Guidance for Superfund (RAGS) states "when the hazard index exceeds unity, there may be a concern for potential health effects." The total cancer risk under the no action alternative is calculated to be approximately 1.5E-3, a much higher probability than the EPA accepted range of 10-5 to 10-7. Note that these calculations were based on the assumption that air concentrations of the COCs are negligible under the no action alternative. Radionuclide concentrations were also not incorporated into these estimates, therefore the calculations should be evaluated accordingly.

## OU4, Solar Braporation Ponds, IM/IRA Rocky Flats Plant, Golden, Colorado Risk Calculations for Surficial Soil File Elezrisk

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	Kisk Assessment								
Contaminant	Concentration	RID on P	RfC [nhal	RfC Inhal <sup>b'</sup>	RO oral" RIC Inhal RIC Inhal <sup>b(</sup> RID derm <sup>s/</sup> SF (oral) <sup>24/</sup>	SF (oral) <sup>a'</sup>	SF (inhi)	SPrinhibble	SP (inh) W SF (derm)
of Concern	(mg/kg)	$(\mathbf{m}\mathbf{s}'\mathbf{k}\mathbf{s} - \mathbf{d}\mathbf{s}\mathbf{r})$ ( $\mathbf{m}\mathbf{s}'(\mathbf{c}\mathbf{u})^{b'}$ ( $\mathbf{m}\mathbf{s}'(\mathbf{c}\mathbf{s} - \mathbf{d}\mathbf{s}\mathbf{r})$ ) $1$ ( $\mathbf{m}\mathbf{s}'(\mathbf{c}\mathbf{s} - \mathbf{d}\mathbf{s}\mathbf{r})$ )	(makeu m)b'	(medee-day)	(me/kg-day)	1 (me/ke - d)	1 Kusten m)	1#mo/kg-d)	1 the frame of the second seco
Aroclor 1254	3.2514	7.00E-05	- -		6.30E-05	7.70E+00		To du du marine	8 SAFE-DO
Benzo(a)authracene	0.83029					7.30E-01			\$ 40B±00
Benzo(a)pyrene	0.88144					730E+00	6.10E+03	2.14PL+07	3.65E+01
Bearo(b)fluoranthene	0.37131					730E-01			3.65E+00
Benzo(ghi)perylene	0.65734								3
Bearo(k)fluoranthene	0.4225					730E-02			3.65F-01
Beryllium	398	5.00E-03			5.00E-05	430E+00	2.40E-03	8.40E+00	4.00F-00
Bis(2-ethylbexyl)pkthalate	8.12991	2.00E-02			1.00E-02	1.40E-02			2 ROH - CO
Cadenium	1221	1.00E-03	] <del>-</del>		2.00E-05		1.80E-03	6.308+00	200
Chrysene	0.9461					730E-03			\$ 15E-00
Di-n-butyi phthalate	0.71318	1.00E-01			\$.00B-02				10000
Phomothene	0.37458	4.00E-02			8.00E-03				
Indemo(1,2,3-cd)pyrene	0.71254					730E-01		Ī	3 65F LOO
Mercary	0.17	3.00E-04	3.00E -04	8.57E-05	3.00E-06				
Nitrate	595.62	1.60E+00			3.20E-01				
Phenasthrene	038155			-					
Prience	038604	3.00E-02			6.00E-03				
Sher	219	5.00E-03			2.50E-03				

-NOTE -

AT = Average Time (days)

BW = Body Weight (kg) EF ~ Exposure Frequency (dayslyr) RD = Exposure Duration (yr)

CF = Conversion Factor (Lgfing)

IR soil = Soil Ingestion Rate (rightay)
IR air = Air Inhalation Rate (m<sup>2</sup>/day)
SA = Exposed Surface Area of Body(cm<sup>2</sup>)
AB = Absorption Factor (unitless)

AF = Adherence Factor (mg/cm<sup>2</sup>/event)

RIETRISK

## Risk Calculations for Surficial Soil OU4, Solar Evaporation Ponds, IM/IRA Rocky Flats Plant, Golden, Colorado File El E2R LSK

ΑF	(meic		- :			1							-	-	-	-		-	_
	AB	3	0.23	4600 0.25	0.25	0.23	25	0.0		1	20		0.25	0.25	١		L	020	0.00
child	Call 2	8	1	99	4600	4600	4600	4600				.1		999		-		4600	4600
l adult	Cm <sup>2</sup>	7100	L	7100			7100	7100	7100		7100		_	7100					7100
lair chi	φ/ <sub>(□)</sub>	18	L	22	18		18	18				18	L	18	18	l _	L	18	18
ir aduli	m <sup>3</sup> /day	8	ន	ន	20	ន	20	ন	20	20	20	8	8	22	20	20	20	8	8
soil adult soil child air adultair chil adult child	$mgday$ ) $\{mgday\} \{m^3/day(m^3/da(cm^2)(cm^2)\}$	200	500	200	2007	92	500	200	88	<b>9</b> 8	98	08	200	200	R	902	200	200	ន្ត
soil adult	(mg/day)	801	81	100	100	92	92	100	8	92	8	8	100	100	8	901	001	100	100
ප්	(kg/mg)	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1,00E-06	1.00E-06	1.00E-06
child	Ê	9	9	9	9	9	9	9	9	Ŷ	9	9	9	9	9	ق	9	9	9
adult	(£)	22	22	24	24	24	24	24	75	*	24	22	z	22	24	24	24	24	24
Ħ	(kg) (days/yr) (yr)	350	350	350	350	350	350	350	350	350	350	350	320	330	350	350	350	350	350
child	3	15	15	15	15	15	15	1.5	15	15	15	15	1.5	15	15	15	15	15	15
adult	(kg)	20	2	2	70	70	70	2	06	92	8	52	20	20	8	6	2	8	R
child adult	(days)(days)	8760	8760	8000	8760	8760	8760	8760	8760	8760	8760	8760		8760	8760	8760	8760	8760	8760
child	9	2190	2190	2190	2190	238	25	2190	2190	2190	2190	2190	2190	2180	2190	2190	2190	2190	2190
AT	(days)	25550	25550	2555	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550
Contaminant	of Concern	Amclor 1254	Benzo(a)anthracene	Benzo(a)pyrene	Bergo(b) Duoranthene	Beazo(ghi)peryiene	Benzo(k)fluoranthene	Berythum	Big(2-ethylheryl)phthalate	Ordenium	Carysene	Di-n-butyl phthaiste	Fluoranthene	Indeno(1,23 -ed)pyrene	Mercary	Nitrate	Phenathrene	Pycon	Silver

AT = Average Time (days) FW = Body Weight (fg)

EF = Exposure Frequency (days/yr)
ED = Exposure Durstion (yr)
CF = Conversion Factor (tg/mg)
IR soil = Soil Ingestion Rate (mg/day)
IR air = Air Inbalation Rate (m'/day)
SA = Exposed Surface Area of Body (cm')
AB = Absorption Factor (unitless)

AF = Adherence Factor (mg/cm²/event)

BIEZRISK

OU4, Solar Evaporation Ponds, IM/IRA Rocky Flats Plant, Golden, Colorado Risk Calculations for Surficial Soil File ELEZRISK

RISK CALCULATIONS

Noncarcinogenic 1.50E 03 8.53E-02 Total Combined HQ 7.59E+00 1.01E+01 7.74E-02 2.34B-01 3.11E-01 7.95E-02 8.37E+00 2.53E+01 3.37E+01 3.47E-04 1.05E-03 1.40E-03 1.56E-03; 4.73E-03 6.29E-03 1.14E-03 3.44E-03 4.58E-03 1.81E-03 5.47E-03 7.28E-03 1.67E-01, 2.22E-01 1.98E-02,5.98E-02 2.51E+00 5.51E-02 Dermal Combined Adult 7.36E-04 7.25E-03 8.02E-03 0.00E+00 0.00E+00 Child Inhalation Adult 236E-01 2.20E-03 5.75E-03 -Combined 6.36E-02 5.94E-01 6.57E-01 1.09E-03 1.02E-02 1.13E-02 9.77E-06 9.12E-05 1.01E-04 1.28E-05 1.20E-04 1.33E-04 1.76E-05 1.65E-04 1.82E-04 5.10E-04 4.76B-03 5.27B-03 6.00E-04 5.60E-03 6.20E-03 NONCARCINOGENICHOS Ħ Ş destion Contaminant of Concern Bis(2-cthylheryl)phthalate Indexio(1,2,3-ed)pyrexe Di-n-batyl phthalate Reaze(b)fluoranthene Benzo(k)fluorauthene Senzo(1)anthracene Henzo(ghi)perylene Benzo(a)pyrene Penanthrene Arroclar 1254 Cadmium Berrillium Chrysene

Total HI

8.52E-04 2.58E-03 3.43E-03

53

SA = Exposed Surface Area of Body (cm²) AF = Adherence Factor (mg/cm<sup>2</sup>/evert)IR soil = Soil Ingestion Rate (mg/day) IR sir = Air Inhalation Rate (m $^3$ /day) EF = Exposure Frequency (days.fr) AB = Absorption Factor (unitless) CF = Convenion Factor (kg/mg) RD = Exposure Duration (yr) AT = Average Time (days) BW = Body Weight (kg) •NOTE -

BIEZRISK

Risk Calculations for Surficial Soil OU4, Solar Evaporation Ponds, IM/IRA Rocky Flats Plant, Golden, Colorado FILE EI EZRISK

	Cancer Risks	ris							-	TOTAL	_
Contaminant	Ingestion			Inhalation			Dermai			CANCER	ER
of Concern	Adult	Child	Combined Adult		Gritd	Combined Adult		Child	Combined RISKS	RISK	ī.A
Aroclar 1254	1.18E-05	1.18E-05 2.74E-05 3.92E-05	3.92E-05		ı	Į	4.64E-04	4.64E-04 3.51E-04 8.15E-04	8.15E-04	<b>.</b>	9E-04
Senzio(a)anthracene	2.85E-07	2.85E-07 6.64E-07 9.49E-07	6.49E-07	_			3.67E-05	3.67E-05 2.77E-05 6.44E-05	6.44E-05		20大型
Benzo(a)pyrene	3.02E-06	3.02E-06 7.05E-06 1.01E-05 0.00E+00 0.00E+00	1.01E-05	0.00E+00	0.00E+00	1	2.68E-04	2.08E-04	2.68E-04 2.08E-04 4.71E-04		SE-P
Benzo(b)finoranthene	1.27E-07	1.27E-07 2.97E-07 4.24E-07	4.24E-07	1		,	1.13E-05	1.13E-05, 8.54E-06 1.98E-05	1.98E-05		2F-05
Benzo(ghi)perylene	-	1	1	-		ı	-	1	ı		
Benzo(k)fluoranthene	1.45E-08	1.45E-08 3.38E-08 4.83E-08	4.83E-08	_	1	_	1.29E-06	1.29E-06 9.72E-07 2.26E-06	2.26E-06		2E-06
Beryllium	8.04E-06	8.04E-06 1.88E-05 2.68E-05 0.00E+00 0.00E+00	2.68E-05	0.00E+00	0.00E+00	1	5.31E-08	5.31E-08 4.01E-08 9.32E-08	9.32E-08		3F -05
Sis(2-cthylhenyl)phthalate	5.35E-08	\$.35E-08 1.25E-07 1.78E-07	1.78E-07		1	1	1.90E-06	1.90E-06 1,43E-06 3.33E-06	3.33E-06		#H-0x
Cadmiuet	Į.	ı	1	00E+00	0.00E+00 0.00E+00		,	,	,	i	
Chrysene	3.24E-09	7.57E-09	1.06E-08		,		4.22E-07	4.22E-07 3.19E-07: 7.41E-07	7.41E-07		101
Di-n-butyl phthalate	1	ı	1	-		1	-		I	i	
Huorauthene	1	1	t	1		,	-	1			
indeno(1,2,3-cd)pyrene	24E-07	244E-07 5.70E-07 8.14E-07	8.14E-07	1	1		217E-05	2.17E-05 1.64E-05 3.81E-05	3.81E-05		#E-03
Mercury		1	1		,				1		
Vitate	-		1	1						1	
Phenanthrene		1	1	-	1	ı	1	1	,	ı	
Prene	_	1	,	1			1		-	i	
Silver.	1	ı	1	ı		1	ı				

AT = Average Time (days) - NOTE -

0.0014929815

Total Cancer

BW = Body Weight (kg)

EF = Exposure Frequency (days.yr)

HD = Exposure Duration (yr)

CF = Conversion Factor (kg/mg)

IR soil = Soil Ingestion Raize (mg/day) IR air = Air Ishalation Raize (m²/day)

SA = Exposed Surface Area of Body (cm<sup>2</sup> AB = Absorption Factor (unitless)  $AF = Adherence Factor (mg/cm^2/event)$ 

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		Modeled	MUCES FIRES	meens rieus riant, Golden, CO	8					
Contaminant of	RA Conc	Air Conc.	RfD onai	RfC Jahai	RfC Inhal	RD derm	SF Corah	ST /2.13	; ;	· ·
13	0 00000	(Carrier )	(mg/kg-day) (mg/cs m)	(mg/cs m)	(mg/kg-day)	(me/kg-day)	ilimater-di	or (mm)	Maybe different 200 (and ) SF (derm)	F (derm)
Barnen	7 000		10-HMF-01			a MR-m	THE CALLED THE	200	d mg/mg di	/(mg/kg-d
Ring? -ethodhavathatst. Lt.	MOA		7.00E-02	SOF-DA	1 420 04	l				
The Land of the La	022	•	2000-C	L		1				
- Dulanone	0.029		200			1.00E-02 1.40E-02	1.40E-02			200
Cadmin	163.06		10-3mg	I.ME+00	2.86E-01	5.40E-01		<u> </u>	<del> </del>	70-2007
Chloroform	2000		1			2.00E-05		and and	1000	
Cyanide	2000	7	╛			1 mar.m	401	3 200 - 100 0.30E+(10	27=+00	
Di-a-batel ahthelete	12.93	٥	2.00E-02			30 100	200 00 10E 03 4.30E 03 8.05E -02 6.10E -03	C) - 10	3.05E-02	10E-03
Tithin-	0.22	0	Ĺ			1.00E-02		_	-	
TAKING MINING THE PROPERTY OF	14.26					1.00E-01	-			
64 an gancee	238.92		, CO.					-	1	
Methyene chloride	Q.D3056	7	2000 C	4,00E - 04	1.14E-04	5.00E-05		$\int$		
Nitrate, Mitrite	1873.4		DUAL TOTAL	3.00E+00	8.57E-01	5.888-02 7.50E-01 4.70E 07 1.25F 02 2.22	2.50E-01	JOE OF	700 000	
Stroathum	0.275		1.00E+00			3.20B-01			.03E-03	.03E-03
Tomene	02169		מתובים היו			6.00E-03		-}-	- -	
7700	4.74	3	3 000	4.00H-01	1.14E-01	1.80E-01	-		1	
			TO- STORE			3.00E-03			1	
THE COL								_	_	

\*NOTE AT = Average Time (days)
BW = Body Weight (kg)
BF = Exposure Frequency (days/yt)
BD = Exposure Frequency (days/yt)
CF = Conversion Factor (kg/ng)
CF = Conversion Rate (rg/kgy)
IR soil = Soil legestion Rate (rg/kgy)
SA = Exposed Surface Area of Rody (cr
AB = Absorption Factor (mitlens)

	3									•	
Contaminant of	AT	BA	1	G	Ë	10	1	2			Noncare.
Concern	(dam)	1	fee) (deserter)		1	IN SOM IN ANY		\$ <sup>°</sup> ,	!	Ą.	ΑT
Date				7		I MENTALY ( IMENTALY	mg/day		78	AB (ms/cm²/even	(dawa)
	KCC7	2	8	2	1.00E-8	92	2n	4200	2	-	100
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utanone	10226	٤	3 5	3	3		3	4700	22		3650
Minor	3	2	8	2	10 1:00E-56	\$	2	82	0.1	-	345
	DCCC7	5	8	2	1.00E65	8	20	4700	0.01	-	3 6
round	25550	R	9	Ξ	1 OTF - OS	Sep	۶	3 5	3	1	2
<b>3</b>	25550	F	Ş	Ş	TOOT OF	3 5	3 3	3	5	-	36.50
-butyi ohthalate	2550	5	3 5	3	TO TOTAL	\$	8	Ê	0.01	1	3650
£	3	2	8	2	10 1.00E-08	480	20	4700	57.0	-	545
	R	9	8	2	10 1.00E - 05	480	7	4304	Š		3
2000sc	25550	٤	Ş	5	10.100	3	3 5	3	3	7	3650
Wene chloride	24490		3 8	3	ALVANE - UC	3	3	4700	0.01		36.50
le Nibrite	2 2	2 1	3	3	T.UUEUS	\$	8	4700	3	1	35.60
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	22530	8	8	2	1.00E-06	480	۶	Ann	Š	;  -	3
90	25550	8	8	2	1 PMR-OX	S.	3 5	3 8	; ;	-	3630
	25550	F	હ	٤	100 1 00	3 6	3	3/4	3	=	3650
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ľ	•										

\*NOTE —

AT = Average Time (days)

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BD = Exposure Duration (yr)

CF = Convention Fuctor (kg/mg)

IR will = Soil Ingustion Rate (mg/day)

RR air = Air Inhalation Rate (m/day)

SA = Exposed Surface Avera of Rober(re)

ESBÉRLSE, WK!

	RISK CALCULATIONS	LATIONS						
	NONCARGINOGENIC HQ's	OGENIC HO	<b>u</b> ô	Total	CARCINOPINIC PIEZE	MIC PIEZE		, , ,
Contaminant of				Nogcarcinomenic	inie	CUCAN OTHER		TOTAL
Concern	Ingestion	Inhalation	Derma	HO				CANCER
elone	7.88E-07		3	Section (No.	THE POST TOTAL	THE CHARTION	Detma	RISK
	46 036 -	0.000	0			•	1	
(a) 11 14 15 15 15 15 15 15 15 15 15 15 15 15 15	1.735-03	00+300°	3.42E-03	S16E-63	1			
(4-cm/mery pathalate	1.24E-05	ŀ	6/TR-05	7.215 06	VF 270 F			
Butanone	\$45R-DR	O COURT OF	\$ 00 D		ı		2.43E-09	3E-03
dmam	20701	l	3.735-00	13196-1		1		
A serificant	TO-12-07		9.00E-01	1,08E+00	1	O O DE + OD		
	1.41E-06		1 38R-(16 :	\$ 10E	1 1770	3		
anide	R ORF - OK			1		U.UDE+00	1.20E-11	THE STATE OF THE S
-n-butyl phthalate	2.4RE-OK		- T. (04)	Train.		1	1	
hine	-		00-2100	K.3E-06		- -	1	
	See See		_		1	1		
Abrilana Atlanta	7.33.5-(2.	0.00E+00	5.27E-01	S81E-01	1			
anyeae calerine	5.74E-07	0.00E+00	77.FE-07	74CD 70C	2 400	ļ		
rate/Nitrite	1.32E-D3		2002	2077	3.09E - 11	0.00E+00	3.69E-11	
outium	C 17E-00		34.30-04	7.00 - CC	_		1	
uene	1 100 00	2 COL	3.00E06	5.X&E-06	-	1	,	
	COLUMN OF	m+amn	1.302-06	2.49B-06	1	1		
	20-216/7		174B-04	192E-04	3			
								F100 100 100 100 100 100 100 100 100 100

\*NOTE -AT = Average Time (days)
BW = Body Weight (kg)
EF = Exposure Prequency (days/r)
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IR axi = Soil Ingestion Rate (mg/day)
IR air = Air Inhalation Rate (m/day)
A = Air and Surface Area of Body (cm²)
A = Air and Surface Area of Body (cm²)

3.02E-09

Total Cancer Risks

171

Total HI

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